Three-axis stabilization of the Block DM-SL during coast periods is provided by two attitude control/ullage engines. Each engine has five nozzles that are grouped in clusters on either side of the main engine nozzle. The attitude control system uses the hypergolic propellants nitrogen tetroxide (N_2O_4) and monomethylhydrazine (MMH).

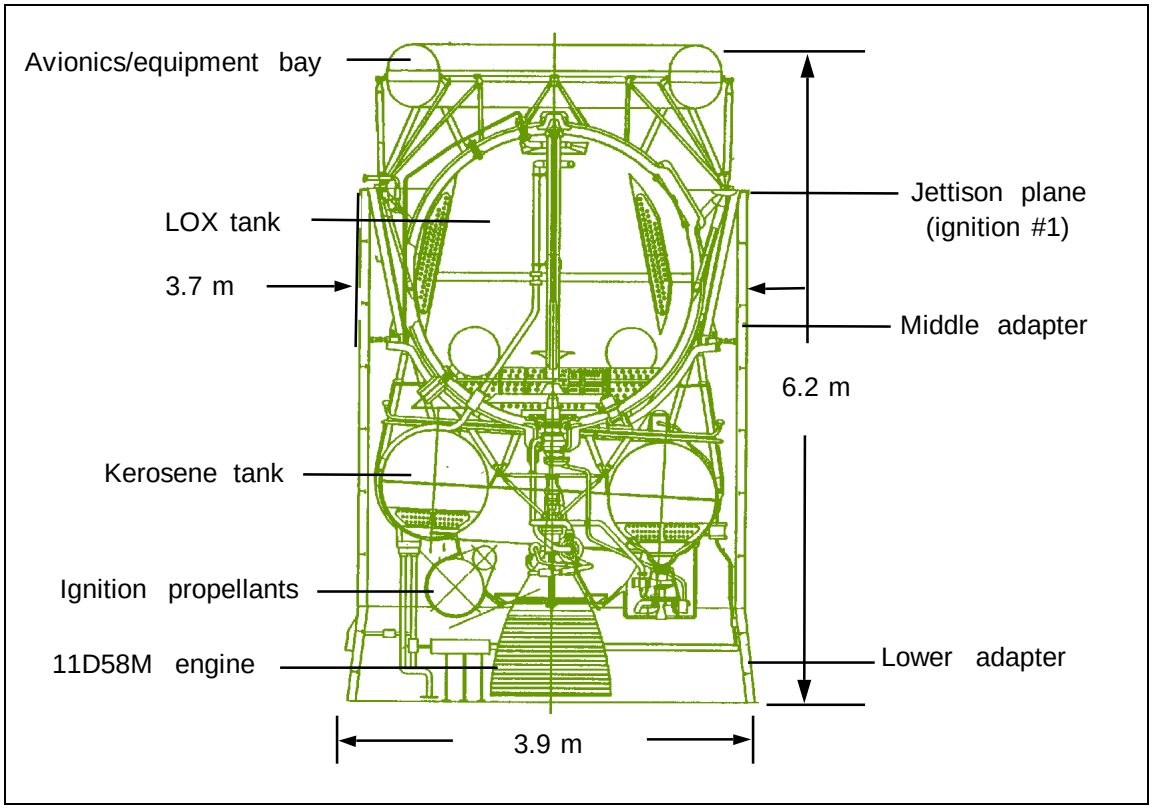

Figure A.1.4-1. Block DM-SL

A.1.5 Payload Unit

The payload unit (PU) consists of the spacecraft, adapter with spacecraft separation system, interface skirt, payload fairing (PLF), and the flight instrumentation package. The PLF, payload adapter (PLA), interface skirt, and spacecraft form a single, transportable item during ground processing (fig. A.1.5-1). These elements are brought together at the payload processing facility (PPF) in the Home Port and are integrated with the launch vehicle as a package onboard the ACS. The PU interface skirt mates to the interfacing ring of the Block DM-SL and encloses its toroidal equipment bay. The PU is 11.39 m long, as measured from the tip of the nose cap to the interface skirt/upper stage interface. The PU has an internal diameter of 3.9 m and an external diameter of 4.15 m.

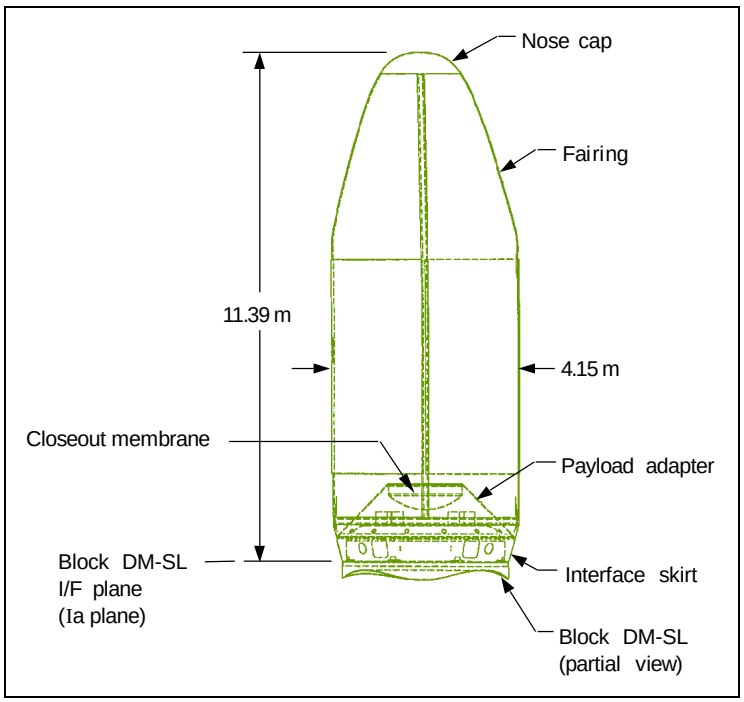

Figure A.1.5-1. Zenit-3SL Payload Unit

A.1.5.1 Payload Fairings

Sea Launch PLFs provide environmental protection for the spacecraft from the time of encapsulation through launch and ascent and can accommodate a wide range of payloads.

The PLF is 10.58 m long and is constructed in two sections of graphite composite external and internal skins. The PLF has a honeycomb core with a metallic nose cap device.

Prior to roll out to the launch pad, access to the spacecraft is gained through the access hatches in the payload fairing. The baseline design includes two PLF access hatches, approximately 0.61 m in diameter, located on opposite sides of the PLF longitudinal separation plane and at least 17^{o} from the separation plane. Within PLF structural constraints, variations in the number, location, and size of the hatches can be accumulated.

Prior to launch, conditioned air is provided to the payload fairing volume. The cooling air flows from the forward end of the PLF to the aft end where it exits through one-way valves on the payload structure.

External thermal insulation protects the PLF structure and limits the interior PLF surfaces from reaching temperatures above 65^{o}C during ascent. The PLF is jettisoned at a time sufficient to ensure that the spacecraft's dispersed maximum free molecular heating (FMH) never exceeds 1,135 W/m^2. The time of PLF jettison (and associated maximum FMH) can be tailored by the customer.

A.1.5.2 Interface Skirt/Payload Structure

The interface skirt/payload structure, which joins the PLF and adapter to the upper stage, is constructed of aluminum with integral stiffeners. The interface skirt portion is 0.81 m long and accommodates the transition from a 3.715 m diameter on the Block DM-SL to a 4.15 m diameter on the PLF. The payload structure portion provides the structural tie between the spacecraft adapter and the

interface skirt portion. The interface skirt/payload structure assembly includes an encapsulation membrane and acts as a contamination barrier between the PU and the Block DM-SL. One-way valves in the adapter structure permit airflow out of the PLF while maintaining positive differential air flow (or pressure differential) in the PLF during all operations.

A.1.5.3 Adapters

The spacecraft adapter, payload structure, and the interface skirt serve as the interface between the spacecraft and the launch vehicle. They physically support the spacecraft in a horizontal attitude for integration with the launch vehicle, during transportation to the launch location, and in a vertical attitude while on the launch pad.

The adapter mechanical interface to the spacecraft is either a bolted or a Marmon clamp design. Spacecraft separation from the adapter is accomplished with separation ordnance or through the release of this clamp.

A.2 MARINE SYSTEMS

The marine segment of the Sea Launch system includes the ACS and the LP, which together will support the integration of the launch vehicle, transportation to the launch location, and launch.

A.2.1 Assembly and Command Ship

The ACS will perform four functions for Sea Launch operations:

1. It will serve as the facility for assembly, processing, and checkout of the launch vehicle.
2. It will house the mission control center, which monitors and controls all operations at the launch location.
3. It will act as the base for tracking the initial ascent of the launch vehicle.
4. It will provide accommodations for the marine and launch crews during transit to and from the launch location.

A first aid clinic will be provided on both the ACS and LP with capability of functioning as a casualty support location in the event of a serious accident.

The ACS (Figure A.2.1-1) is designed and constructed specifically to suit the unique requirements of Sea Launch operations. The basic structure of the ACS is based on a Roll-On/Roll-Off (Ro-Ro) cargo vessel. The ship has an overall length of approximately 200 m and a beam of 32.26 m. Its overall displacement is approximately 30,830 metric tonnes.